

Claims

1. Method for improving plant growth characteristics, comprising increasing expression in a plant of a nucleic acid sequence encoding a GRUBX protein and/or comprising increasing activity and/or increasing levels in a plant of a GRUBX protein, and optionally selecting for plants having improved growth characteristics.
2. Method of claim 1, wherein said increase is effected by introducing a genetic modification, preferably in the locus of a gene encoding a GRUBX protein.
3. Method according to claim 2, wherein said genetic modification is effected by one of site-directed mutagenesis, homologous recombination, TILLING and T-DNA activation.
4. Method for improving plant growth characteristics, comprising introducing and expressing in a plant an isolated nucleic acid sequence encoding a GRUBX protein.
5. Method according to claim 4, wherein said nucleic acid encoding a GRUBX protein is overexpressed in a plant.
6. Method according to claim 4 or 5, wherein said nucleic acid is derived from a eukaryotic organism, preferably from a plant.
7. Method according to claim 6, wherein said nucleic acid is derived from a dicotyledonous plant, preferably from the family Solanaceae, more preferably from *Nicotiana tabacum*.
8. Method according to claim 6, wherein said nucleic acid is derived from a monocotyledonous plant, preferably from the family Poaceae, more preferably from *Oryza sativa*.
9. Method according to claim 7, wherein said nucleic acid is as represented by SEQ ID NO: 1 or is a portion thereof or is a sequence capable of hybridising therewith or encodes a GRUBX protein, wherein said GRUBX protein is represented by SEQ ID NO: 2 or a homologue, derivative or active fragment thereof.
10. Method according to any of claims 4 to 9, wherein said nucleic acid sequence and said proteins include variants chosen from:

- (i) an alternative splice variant of a nucleic acid sequence encoding a GRUBX protein or wherein said GRUBX protein is encoded by a splice variant;
- (ii) an allelic variant of a nucleic acid sequence encoding a GRUBX protein or wherein said GRUBX protein is encoded by an allelic variant;
- 5 (iii) a nucleic acid sequence that is comprised on at least a part of an artificial chromosome, which artificial chromosome preferably also comprises one or more related gene family members;
- (iv) a functional portion of a GRUBX encoding nucleic acid;
- (v) sequence capable of hybridising to a GRUBX encoding nucleic acid;
- 10 (vi) homologues, derivatives and active fragments of a GRUBX protein.
11. Method according to any of claims 4 to 10, wherein expression of said nucleic acid encoding a GRUBX protein is driven by a seed -preferred promoter, preferably a prolamin promoter.
- 15 12. Method according to any of claims 1 to 11, wherein said improved growth characteristic is increased yield and/or modified plant architecture, each relative to corresponding wild type plants.
- 20 13. Method according to any of claims 1 to 12, wherein said increased yield is increased seed yield.
14. Method according to any of claims 1 to 13, wherein said increased yield and said modified plant architecture comprise one or more of (i) increased seed biomass, (ii) increased total number of seeds, (iii) increased number of filled seeds, (iv) increased seed size, (v) increased seed volume, (vi) increased harvest index, and (vii) increased Thousand Kernel Weight, all relative to corresponding wild type plants.
- 25 15. Method for increasing the yield of a plant, which method comprises increasing expression in a plant of a GRUBX encoding nucleic acid and/or increasing activity and/or levels in a plant of a GRUBX protein.
- 30 16. Method for the production of a transgenic plant having improved growth characteristics, which method comprises:
- 35 a. introducing into a plant or plant cell a nucleic acid sequence, a nucleic acid sequence capable of hybridising therewith or a portion thereof, encoding a GRUBX protein or a homologue, derivative or active fragment thereof;

b. cultivating the plant cell under conditions promoting plant growth.

17. Method for the selection of plants having improved growth characteristics, which method is based on the selection of superior allelic variants of a GRUBX encoding sequence and which alleles give rise to improved growth characteristics in a plant.

18. Plants obtainable by a method according to any of claims 1 to 17, with the proviso that said GRUBX protein is not encoded by the nucleic acid sequence represented by the GenBank accession AX927140.

19. An isolated nucleic acid sequence comprising:

- (i) a nucleic acid sequence represented by SEQ ID NO: 6, or the complement strand thereof;
- (ii) a nucleic acid sequence encoding an amino acid sequence represented by SEQ ID NO: 7, or homologues, derivatives or active fragments thereof;
- (iii) a nucleic acid sequence capable of hybridising (preferably under stringent conditions) with a nucleic acid sequence of (i) or (ii) above, which hybridising sequence preferably encodes a protein having GRUBX activity;
- (iv) a nucleic acid sequence according to (i) to (iii) above which is degenerate as a result of the genetic code;
- (v) a nucleic acid which is an allelic variant of the nucleic acid sequences according to (i) to (iv);
- (vi) a nucleic acid which is an alternative splice variant of the nucleic acid sequences according to (i) to (v);
- (vii) a nucleic acid sequence which has 75.00%, 80.00%, 85.00%, 90.00%, 95.00%, 96.00%, 97.00%, 98.00% or 99.00% sequence identity to any one or more of the sequence defined in (i) to (vi);
- (viii) a portion of a nucleic acid sequence according to any of (i) to (vii) above, which portion preferably encodes a protein having GRUBX activity.

20. An isolated protein comprising at least part of one of the polypeptides selected from the group consisting of:

- (i) a polypeptide as given in SEQ ID NO 4;
- (ii) a polypeptide as given in SEQ ID NO 7;
- (iii) a polypeptide with an amino acid sequence which has at least 40.00% sequence identity, preferably 50.00%, 60.00%, 70.00% sequence identity, more preferably 80% or 90% sequence identity, most preferably 95.00%, 96.00%,

97.00%, 98.00% or 99.00% sequence identity to the amino acid sequence as given in SEQ ID NO 4 or SEQ ID NO 7;

(iv) a polypeptide comprising at least an UBX domain, preferably an UBX domain and a PUG domain, and optionally a Zinc finger domain;

5 (v) a homologue, a derivative, an immunologically active and/or functional fragment of a protein as defined in any of (i) to (iv),

with the proviso that the protein sequence is not a sequence represented by SEQ ID NO 2, or database entries Q9ZU93, AAR01744, Q9D7L9, Q9BZV1, Q99PL6, ENSANGP00000020442, Q7SXA8, Q9V8K8, Q96IK9, ENSRNOP00000037228, or
10 AAH07414.

21. Construct comprising:

(i) a nucleic acid sequence encoding a GRUBX protein;

15 (ii) one or more control sequences capable of driving expression in a plant of the nucleic acid sequence of (i); and optionally,

(iii) a transcription termination sequence,

provided that said nucleic acid encoding a GRUBX protein is not the nucleic acid represented in GenBank Accession number AX927140.

20 22. Construct according to claim 21, wherein said nucleic acid encoding a GRUBX protein is a nucleic acid sequence encoding a protein represented by SEQ ID NO 2 or a protein according to any of (i) to (v) in claim 20.

23. Construct according to claims 21 or 22, wherein said control sequences comprise at
25 least a seed-preferred promoter, preferably a prolamin promoter.

24. Construct comprising an expression cassette essentially similar to SEQ ID NO 5.

25. Transgenic plant or plant cell, characterized in that said plant or plant cell has
30 increased expression of a nucleic acid sequence encoding a GRUBX protein and/or increased activity and/or levels of a GRUBX protein.

26. Transgenic plant or plant cell of claim 25 having improved growth characteristics.

35 27. Transgenic plant according to claim 25 or 26, wherein said plant is a crop plant comprising soybean, sunflower, canola, alfalfa, rapeseed or cotton, preferably a

monocotyledonous plant such as sugarcane, most preferably a cereal, such as rice, maize, wheat, millet, barley, rye, sorghum or oats.

- 5 28. Plant cells, plant parts, including harvestable parts and/or products directly derived thereof, propagules or progeny of a plant according to any of claims 18, 25, 26 or 27.
29. Use of a nucleic acid sequence encoding a GRUBX protein, portions thereof or nucleic acids hybridising therewith, in improving the growth characteristics of a plant.
- 10 30. Use of a GRUBX protein, homologues, derivatives and active fragments thereof, in improving the growth characteristics of a plant.
31. Use of a GRUBX protein according to claim 20 in improving the growth characteristics of a plant.
- 15 32. A composition comprising a GRUBX protein for use in improving the growth characteristics of plants.
33. A composition comprising a nucleic acid encoding a GRUBX protein for use in improving the growth characteristics of plants.
- 20 34. Use of a nucleic acid sequence encoding a GRUBX protein in breeding programs.